REMARKS

Claims 1 - 26 remain active in this application. The indication of allowability of the subject matter of claims 5 - 11, 13 - 15 and 25 - 26 is noted with appreciation. The specification has been reviewed and editorial revisions made where seen to be appropriate. Approval for a minor editorial revision of Figure 1B has been requested. Claims 1, 2, 5, 16, 17, 19, 20, 22 and 23 have been amended to improve clarity and form. Support for the amendments of the claims is found throughout the application, particularly in Figures 1A - 1C and the description thereof on pages 15 - 19. No new matter has been introduced into the application.

Claims 1, 3 - 4, 16, 18 - 19, 21 - 22 and 24 have been rejected under 35 U.S.C. §102 as being anticipated by Cao and claims 2, 12, 17, 20 and 23 have been rejected under 35 U.S.C. §103 as being unpatentable over Cao. Both of these grounds of rejection are respectfully traversed, particularly as being moot in view of the amendments made above.

Initially, it is respectfully observed that the Examiner has not relied upon the disclosure of the invention in Cao but only the description in Cao of the prior art; the Examiner citing and relying upon only passages at column 3, lines 49 - 53, and column 2, lines 38 - 41. These passages are descriptive of a repeater amplifier using an erbium doped fiber (an EDFA) in the system illustrated in Figure 1 and as embodied in Figure 2, both labelled "Prior Art" in Cao, while the invention disclosed and claimed in Cao is directed to optical elements which are considered necessary or at least desirable "to prevent laser light of the opposite laser from entering the each respective pump laser" of the EDFA (column 2, lines 61 - 62) or otherwise compromising operation of the system. An EDFA repeater is also discussed at pages 1 and 2 of the

present disclosure and severe wavelength limitations thereof are noted at page 2, line 15.

Most importantly in regard to the present invention, however, while Figure 1 of Cao appears to show bi-directional communication through the erbium doped fiber and co-propagating bi-directional transmission is indicated to be known (column 3, lines 36 - 53), separate fibers must be used for respective directions of communication at the repeater EDFA as shown in Figure 2, Figures 4A - 4C, Figure 14 (described at column 19, lines 25+) and step 2004 of Figure 15 and described at column 3, lines 54 - 63, as necessitated by the generally unidirectional nature of known optical isolators. Therefore, only unidirectional data transmission is allowed in each fiber of the EDFA amplifier, contrary to the explicit recitations of the claims.

Thus, while Cao refers to "a set of optical passive components that together comprise a bi-directional amplifier" (column 4, lines 1 - 2) and "a bi-directional ... amplifier system simultaneously transmitting two separate signal rays in opposite forward directions" (column 4, lines 32 - 35), it is clear from the following paragraph (column 4, lines 44 - 63) that the components of the simultaneous transmissions are, in fact, separated based on their respective wavelengths (corresponding to respective transmission directions) for amplification and later recombined with a reciprocal rotator which performs different rotation depending on transmission direction. Note also that the bi-directional amplifier is formed in two separate components 500A or 500B which operate alternatingly in single directions (see, for example, column 9, lines 7 - 12).

The present invention is based on a very different phenomenon in a very different environment and produces very different effects from a repeater amplifier,

however constituted, and an EDFA repeater in particular. As shown in Figures 1 and 2 of Cao, a repeater amplifier is localized (e.g. to the location of the erbium doped fiber which is not generally used as an optical *transmission medium, per se,* although optical signals are transmitted over it) and placed periodically along an optical transmission path formed by the transmission medium to compensate for attenuation along the optical transmission medium. Regardless of the physical mechanism by which an EDFA may operate, it is limited to particular wavelength bands and is only operable to provide amplification in a single direction at a time.

In sharp contrast, the invention is directed to exploitation of a generally deleterious non-linear optical effect referred to as Raman scattering which occurs in optical fibers having simultaneous bi-directional transmission of different wavelengths therein wherein energy in the shorter wavelength band is transferred to the longer wavelength band; causing higher attenuation of the shorter wavelength signal while reducing attenuation of the longer wavelength signal, as illustrated in "Prior Art" Figure 2 of the present application. Specifically, the invention, by transmitting the excitation signal in the same direction as the longer wavelength and opposite to the direction of transmission of the shorter wavelength, exploits the same effect to transfer energy from the excitation signal to the shorter wavelength signal to thus reduce and/or equalize attenuation with the longer wavelength signal in a *distributed* manner *over the length of the optical transmission medium.* This exploitation by causing additional Raman scattering effects which, in the case of the invention and the direction of transmission of the excitation light in accordance therewith, enhances or effectively amplifies the energy in the shorter wavelength signal and thus

provides, in the terminology of the specification, "Raman *amplification*" which does not significantly affect the longer wavelength light traveling in the same direction as the excitation light but compensates for the increased attenuation of the first wavelength light traveling in the opposite direction by the Raman *amplification* effect (which is essentially a Raman scattering effect but between a short wavelength excitation light and a longer wavelength (but shorter than the second wavelength light) light signal of interest) while the second wavelength light attenuation is reduced by the Raman *scattering* effect. In other words, the particulars of a repeater amplifier such as that of Cao, regardless of type or use of excitation light that may be used, have nothing to do with the invention other than the fact that a repeater amplifier can be employed in a system utilizing the invention or provision for injecting an excitation signal in accordance with the invention can be made in a repeater amplifier.

Further in this regard, it is believed significant to note that, while EDFA effects may be induced without regard to the respective directions of data transmission and excitation light and the respective directions chosen for a particular amplifier are not generally significant due to the localized effect in a relatively short length of erbium-doped fiber, the respective directions of data and excitation light transmission are significant in regard to Raman amplification distributed over a long fiber where light attenuation in the fiber is significant due to the attenuation of both data and excitation light over the length of the fiber as discussed at pages 18 - 19 of the present specification for the increased short wavelength light attenuation to be "compensated", as claimed. The respective directions of excitation light relative to the wavelength-multiplexing/data signal

light in Cao is also opposite to that claimed and would be inappropriate to optimal compensation of the increased attenuation of energy of the first wavelength multiplexing light, as claimed, over a long length of fiber by a distributed effect. This arrangement in Cao further emphasizes that the EDFA amplifier effects therein are localized rather than distributed and that the erbium-doped fiber is not properly considered to be part of the "optical transmission *medium*", *per se*, but only a repeater amplifier which may be used in conjunction therewith and, in any case, not a portion of the transmission medium in which bi-directional data transmissions are permitted.

By the above amendments, the environment of the invention and its effects have been clarified and thus are clearly distinguished from the repeater amplifier, particularly of the EDFA type, discussed in Cao. The conditions required to support the development of Raman *amplification* for the shorter wavelength light are clearly recited in the claims as originally filed but are now clarified in the environment of simultaneous bi-directional transmission in the optical medium, as is the principal effect of compensation of the first (shorter) wavelength light that is transmitted in the opposite direction from the direction of the excitation light as recited explicitly or by reference to the second wavelength light in all claims.

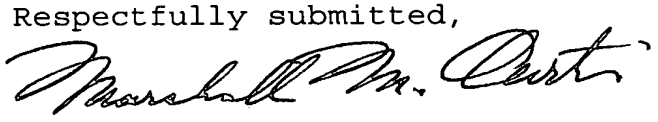
Therefore, it is respectfully submitted that the grounds of rejection asserted by the Examiner are clearly in error and are clearly indicative of a lack of understanding of the invention by the Examiner. Further, in not indicating how Cao answers the claim recitations of the excitation light traveling through or being injected into the optical transmission medium (as opposed to the erbium doped fiber in the repeater amplifier which is not part of the "optical transmission *medium*") in the claims as originally

filed, the Examiner has failed to make a *prima facie* demonstration of anticipation or obviousness of any claim in the application. Accordingly, reconsideration and withdrawal of the grounds of rejection based on Cao is respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041 (Whitham, Curtis & Christofferson).

Respectfully submitted,



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